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ABSTRACT

This conference paper describes trends in federal policy for education of the academically talented in mathematics, science, and technology. Education legislation considered by the 100th Congress has stressed the themes of creating "equity" and "access." The greatest emphasis has been put on education of the gifted and talented. Proposed legislation includes the Jacob K. Javits Gifted and Talented Children and Youth Education Act, Chapter 2 Block Grants, and gifted/talented education for such special groups as American Indians and Native Hawaiians. Legislation for education in mathematics, science, and technology involves Title II of the Education for Economic Security Act; Partnerships in Education for Mathematics, Science, and Engineering; the Star Schools Program Assistance Act; Magnet Schools Assistance Act; Programs for Computer-Based Instruction; and Tests of Academic Excellence. A table presents authorization and appropriation information on programs receiving federal support. The influence of the Executive Branch of the federal government has been felt in the consolidation of categorical programs into state block grants. Thomas Berger's reaction to the paper outlines several recommendations involving federal intrusion, federal monies, textbook quality, teacher subject knowledge, etc. George Tressel's reaction comments on critical self-evaluation, flow patterns through the educational system, and curriculum concerns. (JDD)

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CURRENT FEDERAL EDUCATION POLICY REGARDING THE ACADEMNICALLY TALENTED IN MATHEMATICS, SCIENCE AND TECHNOLOGY

Krista J. Stewart

The purpose of this paper is to describe the federal policy regarding education of the academically talented as it relates to mathematics, science and technology. This task is a reasonable one in that some rather clear trends appear to be emerging. The focus will be on describing those trends and how they have developed.

Before beginning the main focus of this paper, however, a number of points need to be made as a means for laying the groundwork for this discussion. First, consideration must be given to how one might go about determining federal policy. Basically, federal policy might best be thought of as coming from two sources, the Legislative and the Executive branches. Legislative policy is reflected in committee reports, floor statements, news releases, proposed bills, authorizing legislation that is passed, and ultimately in funds that are appropriated. Executive policy, on the other hand, is reflected in documents and statements coming from the Executive branch, in bills that are signed or vetoed, and in the budget submitted by the President to the Congress. In this paper, conclusions regarding federal policy will be drawn from examination of various documents, statements, and legislative efforts.

During this discussion of education of the academically talented in mathematics, science and technology, several points must be kept in mind. First, the 100th Congress has been considering a number of pieces of legislation that have particular relevance for this topic. In many cases, House and Senate versions of bills have differed slightly, representing somewhat differing policy positions. This point will be discussed in more detail when particular legislative directions are discussed.

A second point to keep in mind is that although much attention is being given both to the academically gifted and talented and to mathematics, science, and technology, only rarely are those topics addressed in the same breath. As the various legislative efforts are discussed, attention will be given to how these areas are being addressed.

A final point to keep in mind when considering federal education policy is that only an estimated 8.7 percent of the total expenditures for all levels of education (elementary, secondary and postsecondary) are contributed by the Federal Government; the total Federal expenditure for elementary and secondary education is only 6.1 percent (Department of Education, 1988). In the overall picture, the amount contributed by the Federal Government seems small. The major role of the Federal Government, however, is not one of paying for education but rather one of helping States meet the needs of poor and disadvantaged children and underserved populations, providing leadership on educational issues and problems that are national in scope, and assisting State and local efforts in raising the overall quality of education (Department of Education, 1988). This paper will focus on how the Federal Government, despite its relatively small financial contribution, has had input into education of the academically gifted in mathematics, science, and technology.

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Current Legislative Agenda

This is an active year for education legislation. The main themes in the education legislation are creating "equity" and "access," providing assistance in areas of national priority, and promoting quality. Moreover, emphasis is being given to the critical role education plays in our economic strength and national security (U. S. Senate, 1987). Many of the proposed bills address education of the gifted and talented and the issue of education in science, mathematics, and technology as means for meeting these priorities. Although many of the pieces of legislation were originally introduced as free-standing bills, some have also been folded into other broader omnibus bills. The most active consideration has been given to those bills that have been folded into the omnibus elementary and secondary education bills and the education portion of the trade bills.

The primary piece of education legislation in the 100th Congress is the omnibus primary and secondary education bill, which was introduced in the House as H. R. 5, "The School Improvement Act of 1987", and in the Senate as S. 373, the "Robert T. Stafford Elementary and Secondary Education Improvement Act of 1987." These bills were originally introduced as simple extensions through 1993 of the authorization of Chapters 1 and 2 of the Education Consolidation and Improvement Act. Additional reauthorization bills were used as sources of amendments and provided the basis for the components of the different omnibus bills (U. S. House of Representative, 1987b; U. S. Senate, 1987), with a vote of 401 to 1. On December 1, 1987, S. 373 was incorporated in H. R. 5 as an amendment (i.e., S. 373 was given the number H. R. 5), and H. R. 5 was passed in lieu of S. 373 by a vote of 97 to 1.

After passing the House and Senate, these bills were sent to a Conference Committee in order that differences in the two bills could be resolved. Subsequently, the language agreed upon in the conference, in the legislation now entitled the "Augustus F. Hawkins--Robert T. Stafford Elementary and Secondary School Improvement Amendments of 1988," was passed by the House and Senate (Conference Report, 1988). The bill was signed into law by the President on April 28, 1988.

In the present discussion, an attempt will be made to note and explain some of the differences between the original House and Senate bills. For the sake of clarity in this paper, the Senate bill will be referred to by the number under which it was passed (H. R. 5). In addition, final agreements reached during the conference will be indicated.

A number of education proposals have also included in the trade bill resulting in a certain amount of overlap between the education bill and the trade bill. The education provisions in the House version of the trade bill are included in Title V, "Education and Training for American Competitiveness." The House bill, H. R. 3, the Trade and Export Enhancement Act of 1987, was passed by the House on April 30, 1987. The Senate version of H. R. 3 was amended and passed by the Senate in lieu of S. 1420, the Omnibus Trade and Competitiveness Act of 1987. One reason for including programs in more than one bill is to increase the likelihood of their being signed into law. Although from the beginning the future of the education bill looked bright, President Reagan repeatedly threatened to veto the trade bill,

though not for reasons relating to the education programs (e.g., Auerbach, 1988). All programs that are of relevance to the present discussion that are included in the trade bill are also included in some form in the omnibus elementary and secondary education bill. Thus, primary attention will be given to the education legislation, though programs included in both the education and trade bills will be noted.

In this paper, legislation in two categories will be examined separately: that in gifted and talented education and that in education in mathematics, science, and technology. These areas will be examined separately because no program gives a clearly combined focus. Overlap, where it exists, will be indicated.

Gifted and Talented

During the 100th Congress, the greatest emphasis to date has been put on education of the gifted and talented. This focus appears to be related primarily to increasing concern about the U. S.'s rank among world powers. In legislation for the gifted and talented, the consistent theme that runs throughout is one of the need to make sure that we are educating our best and brightest in order to maintain the U. S.'s competitive position as a world leader.

Probably the strongest proponent in the Senate of programs for the gifted and talented has been Bill Bradley, who has introduced gifted and talented education legislation during the last three Congresses. In his floor statement at the time of introducing S. 303 in the 100th Congress, Bradley noted that the Federal Government is currently playing virtually no role in educating the gifted and talented. He remarked in closing:

> Gifted and talented children represent an invaluable national resource, one that remains sadly underdeveloped. I truly believe our leadership position in the world depends on our commitment to our youth. Our goal must be to do everything in our power to help all students reach their potential level of intellectual development. Special attention to gifted and talented students is called for if our Nation is to maintain and improve its position as a world leader in technology, the sciences, the humanities, and the arts (*Congressional Record*, 1987, S635).

A strong proponent of gifted and talented education in the House of Representatives has been Mario Biaggi. Biaggi has emphasized the importance of providing more effective and more specific services to the Nation's gifted and has described gifted and talented students as "students who could very well hold the key to the future of our nation and that of the entire world" (*Congressional Record*, 1987, E1450).

During the 100th Congress, several free-standing bills regarding education of the gifted and talented have been proposed, some of which subsequently have been folded into other pieces of legislation. As was mentioned earlier, the process of proposing legislation in several forms and through several vehicles increases the likelihood that the legislation ultimately will pass in some form. This section will examine the provisions in the various pieces of gifted and talented legislation that have been proposed during the 100th Congress.

Jacob K. Javits Gifted and Talented Children and Youth Education Act. The primary piece of gifted education legislation to be introduced in the 100th Congress is the "Jacob K. Javits Gifted and Talented Children and Youth Education Act." This legislation was proposed in the House on January 8, 1987, by Mario Biaggi along with 104 cosponsors as H. R. 543. The companion bill was introduced in the Senate by Bill Bradley as S. 303 on January 12, 1987, with 26 cosponsors. H. R. 543 was included in H. R. 5 and S. 303 was included in S. 373. Although several other pieces in each of the omnibus bills make reference to education for the gifted and talented, this piece of legislation is the only one to give primary focus to gifted and talented.

H. R. 543 appeared as Title IV in H. R. 5 and maintained its same title, the "Jacob K. Javits Gifted and Talented Children and Youth Education Act of 1987." The authorization level in the bill was $25 million for fiscal year 1988 and such sums as may be necessary for each of the five subsequent fiscal years. Authorization was included for fiscal year 1988 with the optimistic view that this legislation would pass by the time the fiscal year 1988 budget was completed. According to this legislation, authorized funds were to be used to make grants or contracts to State and local educational agencies, institutions of higher education, and other public and private organizations to assist them in carrying out programs authorized by this section. Programs or projects could include both pre-service and in-service training programs for teachers of gifted students, model programs for the identification and education of gifted and talented children and youth, and for other programs that would strengthen the capability of State educational agencies and institutions of higher education to improve identification and education of the gifted and talented. In addition, this Part would establish a National Center for Research and Development in the Education of Gifted and Talented Children and Youth (a provision also included in the Senate version of the trade bill), the purpose of which would be to stimulate high-quality research that would assist in identifying and serving gifted students in innovative ways. The Secretary of Education would be required to establish an administrative unit within the Department of Education to administer programs authorized by this legislation, coordinate all programs for the gifted and talented, provide national leadership in education of the gifted. Also, the Secretary of Education would be required to appoint a five-person advisory committee to advise on the administration of this Title.

The Senate version of this legislation was included in "Part D" under "Title II" of S. 373 and was introduced at the "Jacob K. Javitis Gifted and Talented Students Act of 1987." The same provisions were made as in the House version except that authorization levels were set at $15 million for fiscal year 1989, $15.8 million for fiscal year 1990, $16.6 million for fiscal year 1991, $17.4 million for fiscal year 1992, and $18.3 million for fiscal year 1993. The Senate version required that at least half of the grants under this Part be awarded to projects that would serve the economically disadvantaged. Also, in the Senate version, the requirement for the advisory committee to the Secretary was not included.

The final version of the legislation agreed upon in conference is entitled the "Jacob K. Javits Gifted and Talented Students Education Act of 1988" (Title IV--Special Programs, Part B--Gifted and Talented Children). The authorization level has been set at $20 million and such sums as necessary through 1993. Parts

common to both the House and Senate bills are included in the final version. The advisory committee to the Secretary, however, has not been included in the final language; throughout H. R. 5, advisory committees have been eliminated because they create a drain on resources that could be used for services. Instead, the bill indicates that the Secretary would be expected to consult with experts in the field of education of the gifted and talented regarding the administration of this Title. The set-aside for programs for the educationally disadvantaged has been maintained (Conference Report, 1988).

The "Jacob K. Javits Gifted and Talented Students Act of 1988" is the primary piece of legislation for gifted and talented in the omnibus education bills. Funding for gifted and talented, however, is also found in several other portions of these bills.

Chapter 2 Block Grants. Federal funds that currently are being used for gifted and talented programs come primarily from Chapter 2 block grants. Chapter 2 funds are distributed to State on the basis of school-aged population, and the funds may be used by the State and local education agencies for any of the more than 30 antecedent programs, or for other educational purposes, one of which is for programs for the gifted and talented (U. S. Senate, 1987).

The Chapter 2 program has been reauthorized in the current omnibus education legislation. In the Committee report for S. 373 (U. S. Senate, 1987), concern was expressed that there have been insufficient accountability requirements for these funds and that in fact the use of funds in some districts has been for general education purposes, leaving specific needs unmet by State and local expenditures. In response to this concern, the Senate bill included language that would have targeted funds by restricting the use of Chapter 2 expenditures to six broad areas. State and local educational agencies would have continued to have the same degree of flexibility in determining their use within the six categories. Programs for gifted and talented was one of the six designated areas. Authorization levels in the bill were $580 million for fiscal year 1991, $672 million for fiscal year 1991, and $706 million for fiscal year 1993.

The House took a slightly different approach to Chapter 2 in H. R. 5. The rationale in the Committee report was as follows:

> First, some studies have been critical of Chapter 2's "unfocused" nature. The Committee did not wish to retarget Chapter 2 on a few specific areas, as has been proposed in some quarters. The Committee's response has been to make Chapter 2 a better vehicle for school improvement by recasting the use of funds in general terms, but with an identifiable theme of improving quality and promoting innovation. These changes are in keeping with the national reports that urge the Federal government to take a leadership role in school excellence and reform (U. S. House of Representatives, 1987, p. 50).

In order to provide State and local agencies with some guidance in appropriate uses of the funds to meet the theme of improving quality, the bill outlined five general areas. One of these general areas was "special projects." H. R. 5 listed several examples of possible special project activities, one of which was gifted and talented education (the others were youth suicide prevention, technology education, community education, and career education). Thus, specific reference to

gifted and talented was made under the proposed legislation for Chapter 2, but the emphasis was less focused and less clear than it was in the Senate bill. H. R. 5 authorized Chapter 2 at $580 million for fiscal year 1988, and such sums through 1993. Thus, the authorization levels were similar to that in the Senate bill.

In the language agreed upon in the conference on Chapter 2, authorization levels are those from the Senate-passed bill. In addition, six categories of use that are somewhat different from either those in the original House or Senate versions are included. The sixth category is for "other innovative projects which would enhance the educational programs and climate of the school, including programs for gifted and talented students, technology education programs, early childhood education programs, community education, and programs for youth suicide prevention" (Conference Report, 1988, p. 83). The fact that other popular programs are included in this category along with gifted and talented may serve to dilute the emphasis on gifted and talented education as a target area. Whether or not more Chapter 2 money will be used for gifted and talented education than was used previously remains to be seen. What originally appeared to be promising legislation for gifted and talented, particularly in the Senate version, may in the end result in little change from the present circumstances.

Gifted and Talented Education for Special Groups. Several bills have been offered during the 100th Congress that would provide for education of the gifted and talented from special groups. S. 150, introduced by Senator Inouye, would provide financial assistance to community colleges and to Kamehameha Schools/Bishop Estate for demonstration grants designed to address the special needs of gifted and talented elementary and secondary school students who are Indian or Native Hawaiian. S. 360, also introduced by Senator Inouye, a bill to improve the status of Native Hawaiians, contains a gifted and talented education component. This bill was passed by the Senate, but was also included in S. 373 as Title X. Section 10006 of Title X made provision for a native Hawaiian gifted and talented demonstration program to address the special needs of Native Hawaiian elementary and secondary students. In addition, this Act required that the Secretary of Education facilitate the establishment of a national network of Native Hawaiians and American Indian Gifted and Talented Centers for the purpose of information sharing. Authorizations for this section were $1 million for fiscal year 1988 and for each succeeding year through 1993.

H. R. 1081, was introduced by Congressman Akaka, as a companion bill to S. 360. This bill was referred to Committee but was also included in H. R. 5 in Part E of Title VIII. The gifted and talented part of this legislation was almost identical in provisions and authorization to that in S. 373 although no requirement for a national network of Native Hawaiians and American Indians was included.

Efforts to seek funding for gifted and talented programs for Native Hawaiians has been part of a broader effort designed to help Native Hawaiian children achieve educational parity with other ethnic groups. Senators Inouye and Matsunaga have been leading this effort in the Senate for more than ten years. Results of a study conducted jointly by the U. S. Department of Education and the Kamehameha Schools/Bishop Estate published in 1983 validated the perceived urgency of the educational needs of the Native Hawaiians. These efforts finally have come to fruition by the inclusion of Education for Native Hawaiians (Title IV) in the conference agreement. With regard to gifted and talented education, both

the demonstration projects and national information network are included, and the authorization level is $1 million for each fiscal year through 1993 (Conference Report, 1988).

Funding for gifted and talented education was also included in the Bilingual Education Program in both H. R. 5 and S. 373 (Title VII in both bills). In both bills one of the stated uses of the funds under this legislation was for gifted and talented programs preparatory or supplementary to programs such as those assisted under this Act. In S. 373 one of the designated research activities authorized to be assisted was "studies to determine effective and reliable methods for identifying gifted and talented students who have language proficiencies other than English" (p. 371). In addition, both bills required that the at least 16 resource centers funded by this act would gather and disseminate information on a particular area of bilingual education, one of which was bilingual education for gifted and talented limited English proficiency students and another which was mathematics and science education in bilingual programs. No specific amount of the authorized funding was set aside for gifted and talented education in either bill. In the conference agreement all of the provisions relating to gifted and talented education are maintained (Conference Report, 1988).

Mathematics, Science, and Technology Education

During the 100th Congress, greater emphasis also has been placed on education in mathematics, science, and technology. The stimulus for this emphasis is similar to that for gifted and talented education, that is, increasing concern about the U. S.'s rank among world powers in this increasingly technological society.

Education in Mathematics and Science. At the current time, the primary source of funding for mathematics and science education has been Title II of EESA. The purposes of the Current Title II under EESA are to improve instruction in mathematics, science, computer learning, and foreign languages; to increase student access to such instruction; and thereby to strengthen the Nation's economic security. The current law authorizes $350 million for fiscal year 1988 and provides that 90 percent of the annual appropriation be allocated among the States. Nine percent of the appropriation is for the Secretary of Education's discretionary grants (special consideration is given to grants for magnet schools for gifted and talented students), and 1 percent is for the outlying areas and Indian students. At least 70 percent of the State allocation is to be allocated for elementary and secondary programs. At least 70 percent of the elementary and secondary allocation is to be distributed by the State educational agency (SEA) to the local educational agencies (LEA's), half on the basis of relative public and private school enrollment and half on the basis of low-income children in public schools.

LEA's may use the funds for improving and expanding the training of teachers and other personnel in mathematics and science and, if the need is met in those areas, in computer learning (no more than 30 percent of the funds) and foreign language (no more than 15 percent of the funds). At least two-thirds of the funds reserved by the SEA for elementary and secondary programs must be used for demonstration and exemplary programs for teacher training and retraining in mathematics, science, foreign language, and computer learning; for instructional

equipment and materials; for underrepresented and underserved groups and gifted and talented children (at least one-fifth of the demonstration and exemplary program funds must be used for this purpose); and for dissemination of information on exemplary programs to LEA's.

Under the current law 30 percent of each State's allotment is used by the State agencies for higher education (SAHE). Not less than 75 percent of this amount is to be awarded to higher education institutions to be used for traineeships for persons who will teach science and mathematics in secondary schools; for retraining secondary school teachers of other subjects to teach mathematics, science, foreign languages, and computer learning; and for in-service training for elementary, secondary, and vocational teachers to improve instruction in these subjects. The other 25 percent is to be used by the SAHE for cooperative programs (20 percent) and assessment of State needs, evaluation, and administration (5 percent).

The purpose of Title VI of S. 373, was to amend and reauthorize Title II of EESA. The Senate bill changed the purpose of EESA Title II by deleting the improvement of foreign language instruction as a purpose of the bill (foreign language was covered under Part B of Title VI of the omnibus bill.) But kept the focus on instruction in mathematics, science, and computer learning. Originally in S. 373, authorization levels were $330 million for fiscal year 1989, $345 million for fiscal year 1990, $365 million for fiscal year 1991, $385 million for fiscal year 1992, and $405 million for fiscal year 1993. When S. 373 went to the floor of the Senate, however, these authorization levels were cut to $280 million for fiscal year 1989, $295 million for fiscal year 1990. $315 million for fiscal year 1991, $335 million for fiscal year 1992, and $355 million for fiscal year 1993. Prior to consideration of the omnibus bill, an agreement had been made to maintain a given authorization cap on the bill. Thus, when on the floor an agreement was made to provide additional funding for two programs, money had to be taken out of other areas and was taken out of Title VI of the bill. Although this action might seem to suggest a lack of commitment to mathematics and science, the original authorization levels were far above current appropriation levels and still were given after the cut in authorization. The authorization/appropriations relationship will be discussed in greater detail in a later section of this paper.

The Senate bill provided that 95 percent of the annual appropriation was to be allocated among the States. Four percent is for the Secretary's discretionary grants (Special consideration was to be given to grants for magnet schools for the gifted), and 1 percent was for the outlying areas and Indian students. At least 75 percent of a States' allocation was to be used for elementary and secondary programs of which not less than 90 percent was to be distributed among the LEA's, half on the basis of relative public and private school enrollments and half on the basis of low-income children enrolled in public schools. No maximum was set for the share of an LEA's funds that could be used for computer learning. Of the SEA funds for elementary and secondary programs, half was to be used for demonstration and exemplary programs. Programs serving underrepresented groups and gifted and talented students were to be given special consideration, but no specific portion of the funds was set aside for these groups as in the current law. Programs for gifted and talented students could include magnet schools.

The Senate bill provided that 25 percent of each State's allocation was to be used by the SAHE for higher education programs. Of this amount not less than 95 percent was to be awarded to higher education institutions for uses similar to current law. No more than 5 percent was to be used for assessment of State needs, evaluation, and administration.

The purpose of Title II of H. R. 5 was to repeal Title II of EESA and replaces it with the Critical Skills Act. In building the rationale for the Critical Skills Act, the House Committee report noted:

> The status of mathematics and science education is still critical: Shortages of properly certified teachers still exist, teachers are still out of touch with new developments in the fields, students are still achieving below their international peers, student enrollment in advanced courses is still declining, and too many programs still lack needed mathematics and science equipment (U. S. House of Representatives, 1987b, p. 60).

The report goes on to cite data from a 1985-1986 survey by the National Science Teachers Association which found that some 7,000 high schools offered no physics course, 4,000 offered no chemistry course, 2,000 did not offer a biology course, and about 17,000 offered no earth or space science. Moreover, almost one-third of all high school students were being taught science or mathematics by teachers who were teaching the courses as their second or third field.

Title II of H. R. 5 changed the purpose of the current law by deleting references to computer learning and foreign language and focused on strengthening national security and economic competitiveness. The House report indicated that although the Committee members believed that foreign language and technology education are important, they felt that because these areas are covered in the trade legislation in H. R. 3, it was preferable not to duplicate efforts when mathematics and science educational funds have been so limited (U. S. House of Representatives, 1987b).

The House bill authorized an annual appropriation of $400 million for fiscal year 1988 and such sums as necessary through fiscal year 1993. This increase in authorization was intended to reflect the Committee's belief that these programs are a high national priority (U. S. House of Representatives, 1987b). Allocation for the States under this bill were to be 94 percent of the annual appropriation with 5 percent for the Secretary to use to make grants (No mention was made of assistance to magnet schools for gifted and talented students.), and no more than 1 percent for outlying areas and Indians students.

The House bill used a different formula for distribution of the money to the States than does current law; in addition to a State's share of population aged 5 to 17, the State's Chapter 1 allocation was to be considered in determining the allocation under this Title. This formula would be likely to direct a greater share of appropriated funds to States with substantial low income populations (Stedman, 1987). H. R. 5 provided that at least 80 percent of a State's allocation was to be distributed to LEA's for elementary and secondary programs, half on the basis of relative public and private school enrollments and half on the basis of low-income children.

The uses of funds specified in the bill were different than those in the current law. Included in the uses were teacher training (Most were in-service activities.), recruitment or retraining of minority teachers to become mathematics and science teachers; financial bonuses to be used for hiring teachers in critical mathematics and science areas; training and instructional use of computers and other telecommunications technology; improving mathematics and science curriculum; partnerships for special instructional programs in mathematics and science; academic and counseling programs to increase participation of specified minority and disadvantaged groups in mathematics and science courses; matching grants for purchasing laboratory equipment; initial funding for mathematics and science magnet schools; and leadership workshops for administrators to improve mathematics and science instruction.

Funds reserved for the SEA, half of which were to be allocated to SAHE's could be used for the following teacher training; exemplary programs to improve mathematics and science training and instruction; evaluation and improvement of State licensing and certification procedures for mathematics and science teachers; special programs to attract minorities and women to mathematics and science teaching; improvement of curriculum; coordination of mathematics and science instruction with increased high school graduation requirements; development of instructional approaches for computers and other telecommunications devices; technical assistance; and small grants to teachers for innovative projects. Not more than 5 percent of the total State grant was to be used by the State for Administration (4 percent for the SEA and 1 percent for the SAHE).

In summary, both Senate and House bills contained a Federal mathematics and science program, the Senate bill being more similar to the current EESA Title II. Both bills, however, contained some common features. Both would have appropriated funds to States by an allocation formula, focused funds primarily on teacher training, and reserved funds for grants to be made by the Secretary of Education. There were, however, substantial differences between the two bills. The Senate authorization level was significantly below that in the House bill and would not reach the current authorization level until 1993. The Senate bill deleted most references to foreign language instruction, but the House bill deleted references to both foreign language instruction and computer learning and was more specific in describing just what activities could be supported under the mathematics and science program. The House's formula for funding took into consideration a State's share of Chapter 1 allocations, a change that would likely result in a greater share of the funds being directed to States with substantial low income populations. Finally, both bills increased the elementary and secondary focus of the mathematics and science program, but the House bill made a stronger move in that direction.

The agreement on mathematics and science education that was accepted in conference is the one that had been reached during the conference on the education portion of the trade bill. In its final form the act is now called the "Dwight D. Eisenhower Mathematics and Science Education Act" and is included as Part A of Title II. The accepted purpose of this legislation was adopted from the House version and is "to strengthen the economic competitiveness and national security of the United States by improving the skills of teachers and the quality of mathematics and science in the Nation's public and private elementary and secondary schools through assistance to State educational agencies, local

educational agencies, and institutions of higher education" (Conference Report, 1988, p. 95).

Authorization will be for $250 million for fiscal year 1989 and such sums as necessary through fiscal year 1993, levels lower than in either the House or Senate bills but still higher than current authorization levels. Table 1 provides a summary of the differences among current legislation, the proposed bills, and the conference agreement regarding allocation of funds for mathematics and science education. The conference language provides that 95 percent of the annual appropriations be allocated among the States; the formula for making funds available to States is the same as the one in the House bill (i.e., taking into consideration a State's share of Chapter 1 allocations). Four percent is for the Secretary of Education to make grants or enter into cooperative agreements (special consideration is to be given to agencies providing special services to historically underserved and underrepresented populations--and especially gifted and talented from within such populations--in the fields of mathematics and science), and 1 percent is for the outlying areas and Indian students. An amount equal to 75 percent of a State's allocation is to be used for elementary and secondary programs of which not less than 90 percent is to be distributed among the LEA's, half on the basis of relative public and private school enrollments and half on the basis of low-income children enrolled in public schools.

The uses of funds by LEA's accepted in the conference language are taken from both the House and Senate language. They include:

1. The expansion and improvement of pre-service training, in-service training, and retraining of teachers and other appropriate school personnel in the fields of mathematics and science, including vocational education teachers who use mathematics and science in the courses of study they teach;

2. Recruitment or retraining of minority teachers to become mathematics and science teachers;

3. Training in and instructional use of computers, video, and other telecommunications technologies as part of a mathematics and science program (which may include the purchase of computers or other telecommunications equipment in schools with an enrollment of 50 percent or more of students from low-income families after all other training needs have been met;

4. Integrating higher order analytical and problem solving skills into the mathematics and science curriculum;

5. Providing funds for grants projects for individual teachers within the local educational agency to undertake projects to improve their teaching ability or to improve the instructional materials used in their classrooms in mathematics and science (Conference Report, 1988, p. 97).

Of the SEA funds for elementary and secondary programs, half is to be used for demonstration and exemplary programs. Programs serving underrepresented groups and gifted and talented students are to be given special consideration, but

no specific portion of the funds is set aside for these groups as in the current law. Programs for gifted and talented students may include assistance to magnet schools.

The conference language provides that 25 percent of each State's allocation is to be used by the SAHE for higher education programs. Of this amount not less than 95 percent is to be awarded to higher education institutions for traineeships, retraining, and in-service training. No more than 5 percent is to be used for assessment of State needs, evaluation, and administration.

Thus, compared to current law, the focus in the new legislation is on just science and mathematics. The funding formula will likely result in a greater share of the funds being directed to States with substantial low income populations. The focus on elementary and secondary mathematics and science is increased. Also, increased emphasis is placed on services to gifted and talented students; wherever underrepresented or underserved populations are mentioned in the final language, gifted and talented is added as one of the designated groups.

Partnerships in Education. Another program originally included in EESA as Title III is "Partnerships in Education for Mathematics, Science, and Engineering." The purpose of this Title is to encourage partnerships in education between the business community, institutions of higher education, and elementary and secondary schools to improve instruction in the fields of mathematics, science, and engineering and to furnish additional resources and support for research, student scholarships, and faculty exchange programs in the field of mathematics, science, and engineering. Grants for this program are to be made by the National Science Foundation, which pays the 50 percent Federal share of the cost of approved programs. This program has been authorized since 1984 and was authorized at $50 million for fiscal year 1988. No funds, however, have ever been appropriated for educational partnerships (U. S. House of Representatives, 1987b).

Both the House and Senate education bills would have reauthorized the partnership program, the House bill at $10 million for fiscal year 1988 and such sums as necessary through 1993, the Senate bill at $20 million for the same period. The House report (U. S. House of Representatives, 1987b) described the lower appropriation as more realistic in light of previous lack of appropriations.

Education partnerships are reauthorized in Section 2301 in the final conference language. The authorization is for $15 million for fiscal year 1989 and such sums as may be necessary for each of the fiscal years from 1990 to 1993. What remains to be seen is whether or not funds will be appropriated for this program (Conference Report, 1988).

Star Schools. The Star Schools Program Assistance Act is a legislative response to the national concern about the increasing numbers of young people who, based on inadequate skills in mathematics, science, and technology, are ill-equipped to survive in a highly technological society. Star Schools was a new title under the Education for Economic Security Act, Title VI in S. 373, but was not included in H. R. 5. The Star Schools Program would:

> provide demonstration grants to partnerships including educational institutions, educational agencies, and entities with telecommunication networking

> expertise. These partnerships will use telecommunications technology (satellite, microwave, fiber optic, cable technologies, and others) to deliver courses in mathematics, science, foreign language and other subject areas to elementary and secondary schools, particularly those serving disadvantaged students, those with scarce resources, and those with limited access to courses in these critical subject areas, as well as to institutions of higher learning, to teacher training centers, and to industry (U. S. Senate, 1987, p. 64).

Not only would instructional programs for students be provided through Star Schools, but also teachers, without having to leave the workplace, would receive the additional training they would need to serve their students better.

The Star School Program has particular implications for teaching mathematics and science to gifted students. Various national reports (e.g., National Science Teachers Association) have concluded that American students receive limited exposure to mathematics and science programs. In addition, the Executive Director of the National Science Teachers Association has estimated that "about 30 percent of all individuals currently teaching mathematics and science in high schools are 'either completely unqualified or severely underqualified to teach those subjects' and over 40 percent of the mathematics and science teaching force will retire by 1992" (U. S. Senate, 1987, p. 68). Many schools cannot afford to offer advanced courses to a handful of bright students, nor may teachers be able to teach those courses. As a result of Star Schools Program, more students could be provided access to courses of highest quality. In addition, teachers would be assisted in integrating telecommunication equipment and materials into their regular curriculum and would be provided with necessary training to update their skills in their subject area.

Authorization in S. 373 for the Star Schools Program was for $100 million for the period beginning October 1, 1988, and ending September 30, 1992. The stipulation was made that not less than 50% of the funds made available in any fiscal year be used to benefit local educational agencies eligible to receive assistance under Chapter 1 of the Educational Consolidation and Improvement Act.

The Star Schools Program was passed as part of S. 373. Prior to its passage in the omnibus bill, however, it had been passed by the Senate as a free-standing bill (S. 778) and as part of education portion of the trade bill. In addition, in the continuing resolution (H. J. Res. 395) Star Schools was authorized with reference to the Senate-passed H. R. 5 and funds were appropriated for fiscal year 1988. In the accepted conference language in H. R. 5, funds were appropriated for fiscal year 1988. In the accepted conference language in H. R. 5, Star Schools is authorized at $100 million for the period beginning October 1, 1987, and ending September 30, 1992 (Conference Report, 1988).

Magnet Schools. In 1972, the Emergency School Aid Act (ESAA) was created in response to federally-mandated desegregation of public schools and provided assistance to local school districts undergoing desegregation. In 1981, ESAA was one of the categorical programs to be consolidated under the ESEA Chapter 2 block grants. However, in 1984, Congress passed the Magnet Schools Assistance Act as Title VII of the Education for Economic Security Act to provide, once

again, specific federal assistance to local school districts in their desegregation efforts.

The Magnet Schools program has implications for mathematics and science instruction for the gifted. The purpose of the magnet schools program is to have distinctive curricular features that are intended to attract students of different races and to reduce, eliminate, or prevent minority group isolation in schools with high proportions of minority students. One objective of magnet schools (the one of greatest relevance to the present discussion) is to provide a course of instruction that will substantially strengthen the knowledge of academic subjects.

Reauthorization of the Magnet Schools program was included as Title III in both H. R. 5 and S. 373. Stipulation was made in both bills that funding was to be used for acquisition of books, materials, and instructional equipment, including computers and for compensation of certified and licensed teachers. The expenses in these areas were to be related to improvement in several curricular areas, the first two mentioned being mathematics and science, thus giving them implicit emphasis. Although no direct mention was made of gifted and talented in this legislation, emphasis was given to strong academic programs.

Authorization levels in H. R. 5 for Magnet Schools were $115 million for fiscal year 1988 and such sums as may be necessary for each of the fiscal years 1989 through 1993. In S. 373, authorization levels were $115 million for fiscal year 1989, $121 million for fiscal year 1990, $127 million for fiscal year 1991, $133 million for fiscal year 1992, and $140 for fiscal year 1993. The Senate bill also made provision for funding a Magnet Schools Improvement Program (Part B) for which appropriations would only be made if the appropriation for Part A of the Magnet Schools legislation were equal to or exceeded $100 million. Authorization levels for Part B were to start at $35 million.

In language accepted in conference, authorization is $165 million for fiscal year 1989 and such sums as necessary for fiscal years 1990 to 1993. Additional funding under the Secretary's Fund ($135 million for fiscal year 1989 and such sums as may be necessary for fiscal year 1990 to 1993) are authorized for alternative curriculum schools having a minority composition of at least 50 percent; funds for this program, however, are not to be appropriated in any fiscal year unless the amount appropriated for Magnet Schools is equal to or exceeds $165 million (Conference Report, 1988).

Programs for Computer-Based Instruction. A new program under Part J, "The Secretary's Fund for Innovation in Education," of Title II in S. 373 was "Programs for Computer-Based Instruction." This legislation would have authorized the Secretary of Education to make grants for the purpose of strengthening and expanding computer education resources available in public and private elementary and secondary schools. The authorization, beginning at $20 million in fiscal year 1989, was for funds that would be divided among this program and four others. In H. R. 5, the Secretary's discretionary funds were available under part B of Chapter 2. The Secretary was to give priority consideration to projects of technology education. Agreements reached in conference on this legislation will be discussed in the next section.

Tests for Academic Excellence. Part C included under Title IX, Educational Assessment and Achievement, of S. 373, was one that could have potential implications for gifted students having outstanding mathematics or science achievements. This part authorized the Secretary of Education to approve or develop comprehensive tests of academic excellence to be administered to identify outstanding students who are in the eleventh grade of public and private secondary schools. In addition, the Secretary was authorized and directed to prepare a certificate for issuance to students who score at a significantly high level (as determined by the Secretary) on a test of academic excellence. Not less than $2 million in each fiscal year was to be reserved from the funds available under the General Education Provision Act to carry out the provisions in this title.

The idea of such testing is not new but was renewed with the issuance of "The Nation's Report Card," a report that came out of a study group chaired by former Tennessee Governor Lamar Alexander. In the Committee report (U. S. Senate, 1987) it is noted that such a test is envisioned as an improved means of assessing student progress and of providing state-by-state information on student strengths and weaknesses. However, the test is not intended to be mandatory either for the LEA or for any individual student.

One benefit of such a test noted by the Committee is that it could help to identify talented students who might otherwise go unrecognized. In turn, an awarded certificate might aid the student in getting a job or in gaining admission to an institution of higher learning (U. S. Senate, 1987).

The idea of such a test, however, has not gone without opposition. Opponents of a test of academic excellence say that such a test would undermine the American tradition of education as a State and local enterprise and would lead to a national standardized curriculum. Proponents, on the other hand, argue that for all practical purposes, national consensus on curriculum already exists (Fiske, 1987).

In the conference agreement, the *optional* Tests for Academic Excellence is included along with Programs for Improvement of Comprehensive School Health, Technology Education, and Programs for Computer-Based Education under the new separate section of the Secretary's Fund for Innovation in Education. This fund is authorized at $20 million and is totally discretionary giving the Secretary the authority to allocate funds in any way he sees fit (Conference Report, 1988).

Other Sources of Funding for Science and Mathematics Education

Not all funding for science and mathematics education is through the Department of Education. Other sources will be discussed.

National Science Foundation. A Science and Engineering Education Activities program is funded through the National Science Foundation. The major activities under this program are research career development, including enrichment activities for talented high school students; materials development research and informal science education; teacher preparation and enhancement, focusing on upgrading the quality of faculty teaching mathematics and science; studies and program assessment to provide a systematic understanding of science and mathematics

education in the U. S.; and undergraduate science, engineering, and mathematics education.

Although there is some overlap in the Department of Education and NSF science and mathematics education programs, funding from the Department is more typically used to support programs at the State or local educational agency level while NSF funds are more likely to be used for grants awarded to colleges and universities. The necessity for coordination of these programs is recognized as indicated by a stipulation in the trade bill requiring coordination of mathematics and science education programs of the Departments of Education and Energy and the National Science Foundation.

The National Science Foundation is currently being reauthorized. Appropriations for NSF will be discussed in a later section.

Appropriations

Although authorization levels set in bills give some indication of Congress' priority for programs, the true test of commitment to a program comes from the amount of money that ultimately is appropriated to the program in a given year. Authorization sets in law a cap for the level at which a program may be funded. It is not unusual, however, for a program to be funded at half or even less than half of its authorization level. Thus, a more accurate picture of the priority being given to education of the academically gifted in mathematics, science, and technology would come from an examination of the actual amount of money being appropriated to programs.

Table 2 presents authorization and appropriation information on the programs that are currently providing primary Federal support for gifted and talented education (i.e., Chapter 2 block grants, though only a small portion of this money is spent on gifted and talented) and mathematics and science education. Both the House and Senate recommendations for fiscal year 1988 appropriations are indicated.

For Chapter 2 block grants, money that could potentially be used by States to support gifted and talented education, both the House and Senate recommended appropriation of $500 million for fiscal year 1988, the same level at which the program had been funded during fiscal year 1987. Because of across-the-board budget cuts, however, the final appropriation was set at $478.7 million, a decrease of 4.45percent from the previous year.

The authorization level for Title II of EESA for fiscal year 1988 is $350 million. Both the House and Senate made recommendations for appropriation at a level far below the authorization. Moreover, the House recommendation was $25 million below the 1987 fiscal year appropriation. The appropriation passed in the Continuing Resolution, however, resulted in a 50 percent increase in funding over fiscal year 1987. An interesting contrast here, and one that emphasizes the importance of considering appropriations rather than just authorization, is that in the current EESA reauthorization legislation, the House-proposed authorization far exceeded that of the Senate.

As was mentioned previously, Star Schools has received appropriation for fiscal year 1988, even though it had not previously been authorized. The somewhat lower appropriation in the Continuing Resolution than had been recommended by the Senate again reflects across-the-board budget cuts.

For the Science and Engineering Education Activities funded through the National Science Foundation, no fiscal year 1988 authorization was ever passed in the Senate, only by the House. The approved appropriation for fiscal year 1988 is only about $10 million below the House's fiscal year 1988 authorization level. Both the House and Senate had recommended an increase in funding compared to fiscal year 1987, although the House recommended a greater increase. The approved appropriation reflects a 40 percent increase in funding in this area in contrast to only a 3 percent increase in research funding and a 6 percent increase in the overall National Science Foundation Funding (these latter figures are provided for sake of comparison).

Comparing Department of Education funding to NSF funding, the House gave priority to NSF education activities and the Senate gave priority to EESA, Title II. Actual appropriations are much closer to authorization level for NSF than for EESA. As was true in fiscal year 1987, NSF science and engineering education funding for fiscal year 1988 is $20 million higher than EESA, Title II funding.

Looking at these programs, the substantial increases in funding relating to mathematics and science education suggests a clear commitment in this area. (Note: in the four years after NDEA was passed, nearly one billion dollars was made available to provide for the various activities under that act.) Particularly in this tight budget year, programs that have received increases of 40 to 50 percent are clearly perceived as priorities. Potentially, some of these funds could be used to improve mathematics and science education for academically gifted students although as previous discussions suggest, the current focus in Congress is on improvement of mathematics and science education for all students. Funds that potentially could be used for gifted and talented education have not been increased and, in fact, reflect across-the-board budget cuts. Thus, for fiscal year 1988, clear priority is being given to mathematics and science education although no clear emphasis is being given to mathematics and science education for the academically gifted. What will be important to note in the new education legislation once it is passed, much of which gives a priority to gifted and talented, is the appropriations that will be made for the various programs. The appropriations for fiscal year 1989 should provide a fuller picture of the focus of Federal support and priorities.

Executive Policy

Although the Congress plays an important role in determining the focus of education policy, the Executive Branch of the Federal Government also influences education policy. As was noted earlier, one consistent theme throughout the last eight years of the Reagan Presidency has been to reaffirm that the control of schools belongs to States, communities, parents, and teachers. Consolidation of categorical programs into State block grants was one of the efforts championed for this purpose.

During the Reagan Administration, numerous reports on the quality of education have been issued through the Executive Branch. The report by the National Commission of Excellence in Education (1983), *A Nation At Risk: The Imperative for Educational Reform* has already been mentioned. As was noted earlier, recommendations were made in this report regarding topics to be covered in various areas including mathematics, science, and computer science.

First Lesson: A Report on Elementary Education in America, a report made by Secretary of Education William Bennett (1986), evaluated elementary school curricula in various academic areas. Regarding mathematics, Bennett concluded,

> Children in elementary years need not only the basic computing skills, but need also to learn how to select the right strategies to solve complicated problems. Our schools face a major challenge in imparting these crucial mathematics skills and problem-solving strategies (p. 27).

In science, according to Bennett, "the challenge before science educators is to develop better means of measuring both factual knowledge and the kinds of understanding students acquire through activities" (p. 28). In discussing gifted and talented students, Bennett indicates that too often education of the gifted and talented is fragmented. He recommends moving away from "the chronological lockstep of age-grading" (p. 61) as well as providing special opportunities in a wide variety of settings.

In some sense, a sequel to *First Lesson* is *James Madison High School: A Curriculum for American Students* (Bennett, 1987). In this report Bennett outlines a high school curriculum that he feels would enable the U. S. to achieve its educational goals. In this curriculum, among other requirements students would be required to take three years of mathematics and three years of science. Bennett emphasizes, however, that neither *First Lesson* nor *James Madison High School* are intended to be a statement of Federal policy because power to mandate school curriculum does not belong to the Federal Government.

Whether or not these reports are meant to reflect policy, they do at least suggest an emphasis being given by the Executive Branch to certain aspects of education. (Because of the focus of this paper, attention has been given here only to how mathematics, science, and education of the gifted are addressed on these reports:) Other means of promoting policy are perhaps more obvious.

One way in which the Executive Branch clearly does state policy is through the President's annual budget. Table 3 provides a comparison of the President's budget requests and appropriation levels in the primary programs funding education of gifted and talented and mathematics and science education.

The President is requesting a 13 percent increase for fiscal year 1989 in Chapter 2 Block grants, the current source for Federal gifted and talented funding. This money would be made available to States and local educational agencies to continue the momentum of the current educational reform movement. However, no specific areas of use are indicated in the budget rationale (Department of Education, 1988).

The President's 1989 request for EESA Title II is the same as the current appropriation. This program, however, did have a 50 percent increase from fiscal year 1987 to fiscal year 1988. The fiscal year 1988 appropriation, however, was 50 percent above the President's 1988 request.

No funding is requested for Star Schools, a program still being considered for authorization as part of the omnibus education bill. Of interest, however, is that funding for some new education programs have been included in the President's budget, even though the pending education legislation has not yet been signed into law (e.g., Parental Choice Open Enrollment Demonstrations). No funding is included in the budget for the new gifted and talented categorical program.

For Science and Engineering Education under the National Science Foundation, the President is requesting a 12.1% increase following a 40% increase in appropriation between fiscal year 1987 and 1988. This increase is about the same as the net increase recommended in the NSF research budget but less than the increase for the NSF total budget; this later increase is primarily a reflection of the President's request for appropriations for science and technology centers.

Comparing Department of Education funding and NSF education funding, the President appears to give priority to NSF. For the last two years, the President's EESA, Title II request has been at a level equivalent to the previous year's appropriation. NSF science and engineering education requests, however, have been well above the previous year's appropriation for both years.

During the Reagan Presidency, categorical funding for gifted and talented was lost, and no other clear efforts to federally support gifted and talented education have emerged. However, gifted students, as a group that deserves special attention, have at least been acknowledged in reports coming from the Executive Branch. Mathematics and science education have received increased support, but Congress (though the appropriations passed) rather than the President (through budget requests) appears to be taking the lead in this area.

Conclusions and Recommendations

The time is one at which a clearer Federal policy regarding educating academically gifted students in mathematics, science, and technology appears to be emerging. Congressional intent, as can be discerned from Committee reports and pending legislation, is that the U. S. should provide optimal education to the best and brightest students to ensure the Nation's ability to maintain its competitive edge. This is not the first time that such a commitment to improving mathematics and science education, particularly for able students, has existed. Thirty years ago, the U. S. made a similar commitment.

One might question why this commitment is having to be made once again. Are Congressional reports merely rhetoric? Does the commitment become diffused as the Federal funds trickle down to the LEA's? Is maintaining a sustained effort for improvement impossible in the context of constantly changing Congresses and Administrations? Does conflict between the Congress and the Administration slow progress? Are the problems ones that are relatively unrelated to Federal policy? Another question that might be raised is whether programs funded by the

Department of Education or those funded by the National Science Foundation are more effective in producing the desired outcomes in educational improvement.

The pending legislation would appear to provide a good base for launching a wide variety of educational improvements, including in education of the academically gifted in mathematics, science, and technology. Although the omnibus education bill now has been signed into law, the true test will come with funding of the programs. Making meaningful appropriations for these programs, during tight budget times, will serve as a reaffirmation of the commitment made in the legislation.

At budget time, legislators on appropriations committees may need to be reminded of the priorities set forth in the education legislation.

The Federal Government can provide the lead in setting educational priorities and can help assist State and local effort. These are necessary and appropriate roles for the Federal Government. How this lead is followed at the State and local level, becomes crucial in determining the improvement of particular programs, teachers, or students.

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Table 1

Percent of Annual Appropriation Allocated Among Recipients Under Current, Proposed, and Passed Mathematics and Science Education Legislation

	Current Law	S.373	H.R.5	Conference Language
I. Outlying Areas/ Indian Students	1%	1%	up to 1%	1%
II. Secretary's Discretionary Fund	9%	4%	5%	4%
III. State Allocation	90%	95%	at least 94%	95%
A. Ele & Sec Allocation	(63%)	(71.25%)	(84.6%)	(71.25%)
1. SEA	[18.9%]	[7.13%]	[9.4%]	[7.13%]
2. LEA	[44.1%]	[64.13%]	[75.2%]	[64.13%]
B. Higher Ed Allocation	(27%)	(23.75%)	(9.4%)	(23.75%)

Note. Percentages in parentheses indicate breakdown of State allocation. Bracketed percentages indicate breakdown of elementary and secondary allocation.

Table 2

Authorization and Appropriation Comparisons for Fiscal Year 1988

	FY 88 Auth	House FY 88 Appro	Senate FY 88 Appro	CR FY 88 Appro	FY 87 Appro	Net Change
Chap 2 Block Grants	Such Sums	$500	$500	$478.7	$500	-4.5%
Title II EESA	$350	$55	$150	$119.7	$80	+50%
Star Schools	--	--	$20	$19.1	--	--
NSF Sc/ Eng Ed	$150	$145	$115	$139.2	$98.9	+40%
NSF Research	$170	$1,505	$1,634.5	$1,453	$1,406.2	+3%
NSF Total	$1,893	$1,793	$1,866	$1,717	$1,623	+6%

Note. Figures represent millions of dollars and are rounded off to the nearest 1/10th.

FY88 Auth = Authorization for fiscal year 1988.
House FY88 Appro = House proposed appropriation for fiscal year 1988.
Senate FY88 Appro = Senate proposed appropriation for fiscal year 1988.
CR FY88 Appro = Appropriation passed in the continuing resolution.
FY87 Appro = Appropriation for fiscal year 1987.
Net Change = Change in appropriation between FY 1987 and FY 1988.
NSF FY88 authorization levels are those passed by the House only.

Source: H.J. Res. 395 Conference Report, House Report 100-498.

Table 3

Comparison of the President's Budget Request and Appropriations

	FY 86 Appro	FY 87 Appro	Pres FY 88 Request	FY 88 Appro	Pres FY 89 Request	Net Change
Chap 2 Block Grants	$478.4	$500	$500	$478.7	$540.5	+13%
Title II EESA	$52.1	$80	$80	$119.7	$119.7	0%
Star Schools	--	--	--	$19.1	--	-100%
NSF Sc/ End Ed	$53.2	$98.9	$115	$139.2	$156	+12.2%
NSF Research	$1,294.1	$1,406.2	$1,635	$1,453	$1,603	+10.3%
NSF Total	$1 457.4	$1,622.9	$1,893	$1,717	$2,050	+19.4%

Note. Figures represent millions of dollars and are rounded off to the nearest 1/10th.

FY86 Appro = Appropriation for fiscal year 1986.
FY87 Appro = Appropriation for fiscal year 1987.
Pres FY88 Request = President's FY88 budget request.
FY88 Appro = Appropriation for fiscal year 1988.
Pres FY89 Request = President's FY89 budget request.
Net Change = Change from FY88 appropriation to President's FY89 budget request.

Source: *Budget of the United States Government Fiscal Year 1988*
Budget of the United States Government Fiscal Year 1989

Discussant Reaction: Encouraging Mathematics and Science Programs for the Gifted and Talented Student

Thomas R. Berger

Krista Stewart discussed the federal funding issue from the top down. I would like to look from the bottom up, taking Minnesota as my bottom starting point. I would also like to discuss what can be in place of what might be. Recommendations must be realistic and work within the present system.

Situation 1. Federal intrusion into education is generally not welcome.

Local school districts are rapidly responsive to voter sentiment which generally does not welcome federal intervention.

I discussed the Chapter 2 block grants with administrators in the Minnesota State Department of Education and with administrators in metropolitan and suburban Minneapolis and St. Paul. Uniformly, they all felt that the newer system of funding results in less paperwork and greater freedom to use the funds creatively. Less intrusion meant better education.

On the other hand, a St. Paul district mathematics consultant felt that without some guidance from the federal government, it was very difficult to obtain funds for either mathematics or gifted education.

Another administrator gave the following example: A district was doing well at the local level meeting a particular need covered by a special federal program. Because of this the district failed to receive funds from a federal program. With targeted special programs, districts may be penalized for having successful local programs.

All administrators felt that federal funds always helped encourage programs in the schools even when the funding was minimal. It is hard to pass up federal bucks.

Recommendation: Federal programs should not prescribe programs to the schools. Rather, there should be priorities placed on the uses of federal monies. A district can spend federal money on a lower federal priority if it is doing well on higher priorities. Gifted education in mathematics and science would be best served if it were set as a high priority in federal programs.

Situation 2. Viewed from the local level, federal monies have always been small compared to local expenditures.

For almost every American home owner school costs represent a significant fraction of every total tax dollar. It is unlikely that the fractions of funding for education from local, state, and federal sources will change significantly.

A typical large school district in Minnesota received about $250,000 from block grant funds last year. Title II demonstration grants averaged about $20,000 each over the past several years.

Some districts try to fold federal monies into their normal operating budgets, diminishing the significance of these funds. On the other hand, a suburban Twin Cities district set up a model program with $20,000 in federal funds. These funds paid part of a district gifted and talented coordinator's salary. This was the first such coordinator the district had. In following years, additional federal monies were combined with state funds to expand the gifted and talented program. As the program became established, federal funding was reduced so that the several coordinators will be supported totally through state and local funds next year.

These coordinators have increased awareness in the district for programs and activities in the schools for the gifted and talented. In particular, in mathematics and science, the district has asked for long range plans from each high school. The district has upgraded mathematics offerings in conjunction with its five year curriculum planning cycle.

The coordinators have increased awareness in academic extra curricular activities. For example, the district recently hosted a regional Odyssey of the Mind competition, and two of the three high schools qualified mathematics teams in the state mathematics league competition. These activities required additional extra curricular support. Federal funding therefore led indirectly to this increased support. This district still has a very low level dollar support for nonathletic extra curricular activities, but federal funds have caused some increases.

Recommendation: If small federal monies are to have much of an effect, they must be administered in a highly conspicuous and highly leveraged fashion.

Situation 3. Federal funds force short range planning.

Congress argues long and hard over its educational programs. The bills pass late and funds are appropriated (or not appropriated) in an untimely fashion. There is probably no cure for this situation.

Recommendation: Congress should make its priorities clear in advance. Federal agencies should receive administrative funds for these priorities the year before the actual program funds are appropriated. A full year administration and notification cycle should precede a funding cycle. School districts might not know how much money will be available but they will have advance notice of programs, priorities, and guidelines.

Situation 4. Grants are often episodic.

A grant is often made with the hope that a successful project will find local funding to continue. States send most of their funds to the schools. Higher education funds are for higher education, not teacher inservice. Legislatures must be taught the value of programs before they will fund them. Unfortunately, this all takes time.

Grants are seed money. The seeds are planted once and a perennial is supposed to grow. Unfortunately, the plant is more like an annual, after the grant runs out, the plant dies.

Recommendation: Good projects should be renewed three, four, or even five times, as long as progress is made toward a permanent outcome.

Situation 5. Teacher renewal projects often suffer from sputtering funding.

Through National Science Foundation grants many innovative teacher renewal programs are being developed. Requests for proposals often go out only a few months before the proposals must be written. It is difficult to write a good proposal in so short a time, especially for new writers.

Proposals must set time lines. For example, a summer project needs faculty, housing, speakers, and other activities. Often funds must be pledged six months before the program begins. Proposals are frequently not reviewed in a timely fashion. Grants are sometimes made in May for a July program. Because of this, some programs must be cancelled for the first summer delaying the program a full year.

Recommendation: Requests for proposals should be issued well in advance. Closing dates for submission should include time for a complete reviewing process and sufficient lead time to allow programs to start six months after the granting date. Such agency planning would be facilitated by a legislative two-year planning-implementing cycle.

Situation 6. Subject area specialists do not communicate with education specialists.

Since 1959 a whole new generation of scientists has come on the scene believing that research is the only true god. Federal research grants allow the funding of investigators, graduate students and visitors. Only those who actually contribute to the research will be funded.

It would be nice if some research grants could include university educators who are not contributors but are observers and learners. The inclusion of such people would force the investigators not only to advance knowledge, but also to clearly explain their investigations. Non-experts would have to understand the principles of the investigation.

Recommendation: Federal scientific research grants should encourage participation by knowledge area scientists by allowing 'educator learners' as fully funded participants in a research grant.

Recommendation: Federal education grants should encourage participation by knowledge area scientists by allowing 'specialist learners' as fully funded participants in both training and educational research grants.

Situation 7. Present mathematics textbooks are weak both in content and in presentation.

Mathematics textbooks have moved to rote computational skills, repetitive easy to grade homework, and emphasis on the simplest algorithms. The competitive textbook market makes all textbooks look alike in their awfulness. Publishers pander to the lowest common denominator.

Present innovations, such as the texts coming out of the University of Chicago School Mathematics Project, are viewed with skepticism by many teachers.

Recommendation: When evaluating any mathematics textbook, ignore chapter introductions, vignettes on famous people, and word problems. There must be a significant number of places in the remaining text where the student can read three English sentences in a row talking about mathematics. This non-mathematicsematical test eliminates almost all present algebra and geometry books.

Recommendation: Federal grants should encourage text writing activities, as they do now. However, federal programs should also encourage the widespread use of and modification of the newly developed materials. Only when the average level of texts improves will there be truly superb texts for the talented in mathematics and science.

Situation 8. Teacher subject knowledge in mathematics and science is currently very low.

While 70 years have been spent perfecting the educational environment, somehow knowledge has been left out. Teachers are highly trained in educational psychology and humane educational methods with less emphasis on knowledge areas. Many high school teachers of mathematics were 'C' level college mathematics students, completing much less than a full mathematics major. Many elementary teachers took no college mathematics courses at all.

Recent tests of teachers in the Twin Cities show that 25% of the fourth through sixth grade teachers cannot score above 50% on a test of simple division skills. One of every four students learns from a teacher who is deficient in mathematics. Administrators in Minnesota agree that the mathematics teachers are frequently not qualified but view replacement by mathematics specialists as a megabuck certification problem. On the other hand, they admit that each building does have a few people who like teaching and are pretty good at mathematics.

Recommendation: Federal programs in elementary schools should place a high priority on identifying good mathematics teachers irrespective of special certification as mathematics specialists. Maximum use should be made of present staff. The first step in the transition to mathematics specialists should not require certification or retraining programs. It is a problem of teacher identification and not certification. These knowledgeable teachers can be used most effectively to influence our best students in science and mathematics.

Recommendation: Teacher training grants made to colleges and universities should have the following priorities: greater emphasis on subject area knowledge; and greater cooperation between education departments and subject area departments. Where appropriate, grants should be administered through subject area departments or in cooperation between education and subject area departments. Only when physicists have some influence in teacher education will the physics teachers improve.

Situation 9. Except in extremely populated areas, the public schools cannot serve the exceptionally gifted and talented.

The University of Minnesota Talented Youth Mathematics Program (UMTYMP) has at most seven students from any high school. The only school sending this many is an inner city magnet school. Assuming that this program serves only 50% of exceptionally talented mathematics students, a four year school may have fourteen such students scattered over all four grades. It is not possible to form classes with three students. Even a district with four high schools probably could not justify a pullout problem.

Only a multidistrict pullout program (such as UMTYMP) or a special school (such as the North Carolina School of Science) can gather enough students to form adequate size classes. Because the cost of a special public residency school is very high and students must leave their homes, pullout programs might be preferable.

These pullout programs work. In Minnesota's first appearance last year at the American Regional Mathematics league national final, the state entered two teams which took third and sixth place in the 'B' division. These teams were dominated by UMTYMP students. Almost all high scorers on the American High School Mathematics Examination from the Twin Cities area are in the UMTYMP. The national winner in the Mathematics Counts competition a year ago was an UMTYMP student from Moorhead, Minnesota. UMTYMP students have been invited to study with the Olympiad team. UMTYMP students dominate the list of Twin Cities national merit finalists.

Recommendation: Federal programs should set as a highly priority special mathematics and science pullout programs which transcend school district boundaries. Federal school district funding should encourage cooperation between school districts and such pullout programs.

Situation 10. Americans have developed a very humane educational environment.

We have possibly the finest educational environment in the world. Parent satisfaction with schools is higher than in other countries, and student emotional problems do not seem to be as severe.

Recommendation: We do not want to alter, in a big way, the emotional environment created in our system of education. Gifted programs should continue the caring environment of our schools.

Discussant Reaction:
Current Federal Policy Regarding the Academically Talented In Mathematics, Science and Technology

George W. Tressel

If the flurry of the activity that Krista has discussed sounds bewildering, that's Washington. When someone says, "The sky is falling!" the classic Congressional role is to listen and deliberate. Then, if appropriately impressed, they provide some general ground rules and resources, and they settle back in the hope that someone will figure out the details.

This is all that we should expect from a legislative body, but it also is part of the reason for the hot and cold running water syndrome that we have seen in science education. The last time, Congress responded because "The Russians were coming!" Now we're doing it again because "The Japanese are coming!" Neither is a particularly good reason to turn the faucet on, but it is fortunate that science education is getting attention; and considering the complexity of the problems, it's remarkable that Congress does such a good job.

As long as Congress continues to do its part--providing the resources--it becomes our problem to warrant this support, and to provide some of the stability that Dr. Stewart was talking about.

Many years ago I drew a moral that stays with me today. For a couple of years, I worked on the atomic airplane project: a waste of roughly a billion dollars of your money. In the end I resigned because I felt that it was an unethical and unconscionable waste. Ten thousand people worked on the project; yet I never found anyone besides myself who had such qualms. Nor in the years since, when I see my old colleagues, have I found any doubt that it was in the national interest.

The moral I draw from this is that it is almost impossible for people to engage in critical self evaluation when a serious self interest is involved. We all look at life through a strong filter of self interest. Since all of us here are from the academic and research communities, that is *our* filter of self interest. I'd like to pose an alternative--a view with a bit less emphasis on our quest for knowledge and research support.

We all agree on the need for more knowledge, and we certainly should be doing more research, and we certainly need to find more ways to apply our knowledge. BUT . . . Congress is not sending over a hundred million dollars a year because they think this is an academic question. They are persuaded that the U.S. faces serious problems, both in economic and technological competition with other countries and in the skills and knowledge of our next generation.

Congress is sending money because they want something *done* about this. And knowledge and research are only good in so far as they help.

As we all know, education presents an enormous *system* problem. This system, with its diffuse authority, low status and enormous inertia, has deteriorated noticeably and must be repaired. How do we do that? Rhetoric about support for gifted and talented is common, but I don't hear a central philosophy or

perspective. It just seems like a good idea; who could argue against help for the gifted and talented?

There are some important tradeoffs that should be weighed--between the chaos of neglect and the smothering embrace of a "Federal Curriculum," which no one wants or would accept. Perhaps the populist control, and the flexibility of our system is the reason that it has done so well over time, despite its clear weaknesses.

Let me describe the system a bit, and some of the concerns that we see at NSF. The 16,000 independent school systems--largely held together by little more than the College entrance requirements--present a reality that we must work with. Consider the "envelope" of flow throughout the system.

Most of the population completes elementary school, but by the time you reach the end of four years of high school, roughly twenty-five percent has dropped out. Only seventy-five percent completes high school. Roughly fifty percent goes on to college and roughly twenty-five percent completes four years. Then the flow drops to about five percent that enters graduate school--and after further attrition, this "tail" becomes the "intellectual resources" of the country.

Within this envelope, what do we do about science education? To begin with, the process has split the population in two halves. We tend to forget that half the population does not make it past high school. The other half, by and large, has four years of college or less. That is why newspaper ads specify "college graduate" or not: they usually aren't seeking a particular skill; they are specifying a person from one or the other half of the population.

What do these two portions learn about science and technology? In elementary school, for all practical purposes, in most schools most of the time for most children, *there is no science.* Science starts at the age of fourteen when someone takes a kid who, by and large, has no background, no preparation--except what they learned informally from parents, books, museums, hobbies, etc.--and asks whether this unprepared youth would like to take things like Botany, Zoology, Chemistry and Physics.

Usually the answer is "No." Twenty-three percent of the population takes enough to be considered meaningful (three years of mathematics/science) and even for this portion, it is not for career interest; it is to get into college. Less than one in five who take these courses do so because they are interested in mathematics or science as a subject or as a preprofessional topic.

The motive is then played out when they do get to college. Roughly five percent takes mathematics/science/engineering and that drops to roughly half by the end of four years; and less than one percent goes on to graduate study. This then, is the source of our technical infrastructure. Do you think that the process is systematically preparing, encouraging and selecting our best prospects from every part of the population? Do you think that most of our potential talent is being nurtured and prepared for an education and role that will develop its potential? I don't.

Given this flow pattern, do you think that we can solve our need for more scientists and engineers by recruiting more at the undergraduate level? When we're already taking more than one out of five of the twenty-three percent who are "prepared." Maybe we can, and I wish us luck because we're going to try. And we're probably going to lower standards in order to do so.

The truth is that if we really want to do something about this, we must address the demographics of our country, and find the people who traditionally say no to the question of whether to take science or mathematics when they are fourteen years old. The ones who say no traditionally fit into two categories: women and minorities. We can't afford that, and we've got to do something about it. We have to change the pattern.

We can of course, try to recruit more at every stage. But the trouble with our system right now--if there is a single core problem--is probably that we rely almost entirely on this approach: a system of *testing and selecting,* instead of *cultivating and teaching.* As long as we have this pattern, nothing much will change.

That is why we in NSF's curriculum programs are focusing our highest priority at the elementary school years, where there is still time to change the course of events. Our efforts are directed toward building a broad spectrum of talent, not just the next Nobel Prize winners. Not just "scientists," but also engineers, technologists and support cadres. We need a full technological infrastructure and managers and decision makers who understand enough science to carry on an intelligent conversation with an "expert."

Where then do the gifted and talented fit in this pattern? To review, we need three kinds of people:

1. An educated populace that can read about science and technology in the newspaper,

2. Managerial and decision-making cadres that can converse with and weigh the views of scientists and engineers,

3. The science and technology infrastructure.

Leading this technological pyramid must be the gifted and talented. How do we provide this?

First, we must establish a base-line science education for all students in both science and mathematics. This should be co-equal in priority with language and cultural arts; science is the humanities of our time.

This base-line mathematics/science curriculum should serve as a strong preparation for preprofessional courses, in chemistry, physics and so on. It should also provide a universal overview in preparation for college science. And it should provide a science literacy for the fifty percent of students who are going to stop at the end of high school.

Second, we must upgrade the level and standards of our disciplinary courses in keeping with the ever more demanding content and standards of preprofessional preparation.

Finally, we should parallel this higher standard of disciplinary curriculum with special programs for the gifted and talented: programs like TIP and SMPY. In this ideal system, every child would get a base-line preparation. Those intent on a career would study with others who have the same motivation and preparation. And for every student that shows exceptional talent and promise there would be a program of cultivation and encouragement.

Whatever the level of ability, skill and motivation, there should be a program of encouragement and challenge. And that includes the "severely gifted."

That's easier said than done, of course, but we at the National Science Foundation are determined and trying to provide a catalyst. There are significant trade-offs between the roles of different agents--even in the government. Dr. Stewart mentioned the differences between NSF and the Department of Education; the two agencies have complementary but very different strengths. NSF is closely linked to the academic community; we have many links to research workers, developers and so forth. And we're learning to work closely with school systems and educational marketers.

At this time, we have eight "troika" projects that combine academics, school systems and publishers, all working together as a team. All but one are at the K-6 level; this year we expect to start a number of middle school projects, and next year we will make a half dozen of the same genre for high school. Together, they will establish a number of coherent K-12 base-line science alternatives. Meanwhile, we're also working on improving the mathematics curriculum to focus more on problem solving, computers and contemporary applications.

So, NSF is especially good at research and development. But we are neither well experienced nor well equipped to work at the local level with SEA's and LEA's. Nor should we be. These are areas that require large scale funding and direct local involvement. They are much better suited to the nature, funding, style and experience of the Department of Education.

Recognizing this, I can't close without mentioning the primary weakness in the development strategy that I've been describing: *implementation.*

In a few years, these publishers will offer a half dozen alternative science curricula to school systems. The most frustrating thing would be if systems were not prepared or funded to by the materials--and the teacher training programs to accompany them. It is not going to be easy, and it is the border where responsibility transfers from NSF to state and local decision makers.

We need their help and we hope that our efforts will serve their needs. Our schools need large and difficult changes. We need to change the teachers' roles. We must provide more time for teachers to plan, more support staff so that teachers can be more professional and focus their attention on their real job, and better facilities to do the hands-on, experiential learning that all of us endorse. We at NSF hope that our efforts contribute to this picture.